Survey Protocols for

***Bondarzewia mesenterica* (= *B. montana*)**
Otidea leporina
O. onotica
O. smithii
Polyozellus multiplex
Sarcosoma mexicana
Sowerbyella* (= *Aleuria*) *rhenana

Version 1.3

by

Thomas E. O'Dell

TABLE OF CONTENTS

Introduction

A. Introduction to the Issues

Protection of old-growth forest related species was a governing principle in the development of the Northwest Forest Plan (NFP). Species protection measures are addressed by numerous Standards and Guidelines applying to all land allocations designated by the NFP (U.S. Department of Agriculture and U. S. Department of the Interior 1994a, 1994b). The "Survey and Manage" standards and guidelines provide benefits to numerous taxa by categorizing various species into four management strategies that differ in priority of implementation. Strategy 1 requires the management of known sites. Strategy 2 and the "Protection Buffer" mitigation require surveys prior to any ground disturbing activities within the range and habitat of the species (USDA and USDI 1994a). The goal of these surveys is to identify new sites. If new sites are detected, they are to be managed according to species-specific management recommendations. This document provides the survey methods developed for *Bondarzewia mesenterica (=B. montana), Otidea leporina, O. onotica, O. smithii, Polyozellus multiplex, Sarcosoma mexicana, and Sowerbyella (=Aleuria) rhenana.* Use of the methods in this document provides a reasonable effort to find the species if it is fruiting in a given year. These species may be present in an unidentifiable form (mycelium) which may not be detectable without several consecutive years of survey as described in this survey protocol. *B. mesenterica* is a Strategy two species. *Otidea leporina, O. onotica, O. smithii, Polyozellus multiplex, Sarcosoma mexicana, and Sowerbyella (=Aleuria) rhenana* are Protection Buffer species.

Separate documents address the management recommendations for these species (except *Sarcosoma mexicana*), and provide a thorough review of the known elements of the species biology relevant to effective management (Castellano and O'Dell, 1997).

These species are considered to be closely associated with late-successional coniferous forests and have been classified as Survey and Manage Strategy 1, 2 and 3 or Protection Buffer Species, under the Final Supplemental Environmental Impact Statement/Record of Decision (ROD)(USDA and USDI 1994a). These species are also considered to be globally rare, uncommon or threatened throughout their range, and critically imperiled in Oregon by the Oregon Natural Heritage Program (1998). The designations for these species reflect a high level of concern for maintenance of species viability.

B. Unique Characteristics, Biology, and Ecology of Each Species

The management recommendations for Survey and Manage Strategy 1 fungi (Castellano and O'Dell, 1997) provide information regarding the nomenclature, taxonomy, ecology, and range, including detailed descriptions, of all the species except *Sarcosoma mexicana* (see below). The suspected range for these species includes all of the NFP area because the known sites are broadly distributed and there is presently little information available to refine the range. New sites of some species have been found in habitat conditions and portions of the NFP where they have not been expected. Thus, until more is known about the distribution of these species, it is premature to exclude any part of the Northwest Forest Plan area. Some additional comments on the morphology of *Bondarzewia mesenterica* are also provided below. Photographs are included in Castellano et al. (in press) and can be viewed on the world wide web at http://mgd.nacse.org/fsl/survey/RODlist/funtab.html.

1. Additional species biology information

Bondarzewia mesenterica, in addition to the information cited above, sporocarps (of this , species) emerge from the soil as an irregular column or mass of fused columns with a lumpy, tan to orange apex, whitish sides, and a large, underground, mass of root-like tissue (see photos).

Sarcosoma mexicana (Ellis and Halloway) Paden and Tylutki is a cup fungus (Ascomycota, Pezizales) in the family Sarcosomataceae. It forms black, turbinate (inverted cone) to discoid (saucer-shaped) sporocarps up to 9 centimeters across. The most important feature distinguishing this species in the field from other similar species of "black cups" is the heavy gelatinization of the context (i.e., the interior, "flesh" or tissue); sporocarps typically appear to be entirely gel-filled. A technical description and additional photo can be found in Tylutki (1993, p. 30); Arora (1986 p. 828) also has a photograph and description. The mention, by these authors, of oil droplets in the spores is not diagnostic.

S. mexicana is found in mid to late -seral coniferous forests with a wide variety of habitat conditions. This species is widespread in western North America. Since 1996, 85 collections (not necessarily from distinct sites in every case) have been made in the range of the northern spotted owl, from Mendocino County, California north to Columbia County, Oregon.

C. Objectives

The survey method for these species is designed to ensure a reasonable effort to locate the fungi if they are fruiting in the appropriate season in the year when surveys are conducted. Because of the annual variability in sporocarp occurrence, no single year method can provide high confidence in determining presence or absence of these species (O'Dell et. al. in press). The additional challenge of finding sporocarps which are (except for *B. mesenterica* and *Sowerbyella rhenana*), darkly colored and, except for *B. mesenterica*, small and inconspicuous, adds to the uncertainty of detection.

One or more completed survey visits within one year's field season prior to transmittal of this protocol, but following the methods and timing presented here, is considered to have partially (or wholly if three visits were done) met the requirements of this protocol under the above objective and the direction in the transmittal memorandum. For example, one completed survey visit for fall-fruiting fungi after the start of fall rain in 1999, but before transmittal of this protocol, may be used as one of the three prescribed visits. However, one fall visit in 1998 would not count as one of the fall visits for 1999.

D. Trigger for Protocol

Standards and Guidelines (S&Gs) for some Survey and Manage (S&M) and Protection Buffer species in the ROD for the NFP direct the agencies to conduct surveys prior to ground-disturbing activities within the known or suspected ranges and within the habitat types or vegetation communities occupied by the targeted Protection Buffer and Survey and Manage Strategy 2 fungi (USDA and USDI, 1994a). Ground disturbing activities with potential to impact populations of these species include, but are not limited to timber harvest, road and, trail/campground construction. Surveys are needed prior to actions which disrupt stand conditions necessary for survival of the species. These include activities that cause removal of host trees or modification of microclimatic conditions required for fruiting and survival, such as logging, road, trail, and campground construction. The goal of these surveys is to identify new sites.

E. Threats to the species

Threats to these species are those actions which disrupt stand conditions necessary for their survival. These include activities that cause removal of host trees or modification of microclimatic conditions required for fruiting and survival, such as logging, road, trail, and campground construction. All of these species except *S. mexicana*, are apparently obligate biotrophs. Their hosts include forest trees; removal of which eliminates the energy source of the fungi.

With the exception of *Polyozellus multiplex*, these species are not routinely harvested for use as food. It is uncertain whether harvest of *P. multiplex* constitutes a threat to the species, but results from experimental harvest of other species do not evidence any harm to harvested populations (Egli et al., 1990; Norvell, 1995). Fugal sporocarps are fruiting structures produced from longer-lived mycelium. Therefore, it is unlikely that simply removing the sporocarps would have an adverse impact on the whole organism.

F. Specific Habitat Associations

Habitat, microsite, and months of occurrence are given for each species in the table below. For several species these are quite broad, reflecting the ecological amplitude for the species, or the lack of specific habitat information from which to draw conclusions. Additional information on habitat can be found in the Management Recommendations (MRs) (except for *Sarcosoma mexicana*) and the field guide on the world wide web at http://mgd.nacse.org/fsl/survey/RODlist/funtab.html.

The following table shows habitat and suggested time for survey based on records of past observations. Because the fungi respond to the season and weather, especially the temperature and moisture conditions, the recommended months of survey are estimates. The actual timing of surveys may vary annually, based on weather. If the season is cold or dry, the survey season may be shorter than that recommended; if it is warm and moist, the survey season may be longer than recommended; if the rain is late and conditions remain above freezing, the season may be extended. See "Timing of Surveys" section for specific guidance.

Species	Habitat	Microsite	Months of occurrence	Recommended months for survey
Bondarzewia mesenterica	Forests with a significant conifer component.	Snags, stumps, and on soil near them.	August - December	August - December
Otidea leporina	Forests with a significant conifer component.		Aug. - Dec.	Aug. - Dec.
Otidea onotica	Forests with a significant conifer component.		Sept. - Dec.	Sept. - Dec.
Otidea smithii	Forests with a significant conifer component.		Sept. - Dec.	Sept. - Dec.
Polyozellus multiplex	Forests containing *Abies spp*.	Topographically moist places: near perennial and ephemeral streams, swales and depressions	Sept. - Nov.	Sept. - Nov.
Sarcosoma mexicana	Forests with a significant conifer component.		All months except Sept. and Oct.	Dec. - June
Sowerbyella rhenana	Forests with a significant conifer component.		October - December	Oct. - Dec.

Inventory Methodology

A. Sampling Procedures

The intensity of surveys for these species in a proposed project area prior to ground disturbing activities has been categorized into three types: Pre-field Review, Intuitive Controlled Surveys, and Complete Surveys.

1. Pre-field Review

The objective of the pre-field review is to determine if known sites are present in, or in the vicinity of, the proposed project area and to determine if potential suitable habitat for these species exists in the proposed project area. Consult the current Known Site Database (KSDB) or Interagency Species Management System (ISMS), GIS layers and available data for the area of interest to determine if known sites occur in the area. Evaluate the available information to determine the location and habitat of populations of these species. Mark the locations of known sites on topographic maps and aerial photos for use in the field survey.

Evaluate available information to determine if potential suitable habitat for these species exists in the proposed project area. Specific habitat conditions for these species are described in section I.F of this document, the Management Recommendations or the Fungi Field Guide, and the current known site database. To determine whether such habitat conditions exist in the proposed project area, consult information sources such as GIS coverages of potential or current vegetation, stand age maps, stand exam data, ecology program database, USFS Current Vegetation Survey (CVS), botany program records, predictive habitat models, and individuals with knowledge of the project area. Delineate the areas of probable suitable habitat for these species on topographic maps and aerial photos to be used in the field survey.

The pre-field review will identify reported sites of these species and areas of suitable habitat for this species within the proposed project area. These are the areas where the survey will be conducted. Field surveys are required if the species is known to exist in the proposed project area or in the vicinity, or if it is determined that potential suitable habitat for these species is likely to exist in the proposed project area. Documentation of the pre-field review will become part of the administrative record.

2. Intuitive Controlled and Complete Field Surveys

The objective of the field survey is to document the presence of the fungi if they are fruiting within and adjacent to the proposed project area during the time surveys are conducted. Collecting additional information to characterize the habitat and ecological conditions where the populations occur, as well as extent and abundance of the species, although optional, is highly recommended. Information from this additional data collection is important for refining our knowledge of the distribution and ecological requirements of these species throughout the area of the Northwest Forest Plan. Better habitat and distribution information may result in significantly reducing the area considered potential habitat and requiring survey in future years.

Intuitive controlled inventories are particularly effective when performed over a large area (e.g., ground disturbing activities greater than one hectare (2.5 acres). It would be reasonable to expect that one trained, experienced surveyor looking in terrain that is not excessively steep could cover 24-40 acres in a day. Conduct the intuitive controlled survey by traversing through and around the

proposed project area, visiting areas delineated on the topographic map and aerial photos as known sites or probable habitat for the species. These species are found in the habitats and micro-sites listed in section I.F. of Management Recommendations, or the Fungus Field Guide. Search these micro-sites for the presence of the species. If a particular micro-site is not given for the species, a complete survey is recommended. Delineate on the topographic map and aerial photo the aerial extent of the field survey and route traversed.

Complete surveys are defined as a 100 percent visual exam of potential suitable habitat in the survey area, as defined below (section B). Complete surveys are particularly effective when performed over small areas less than one hectare (2.5 acres). During controlled intuitive and complete surveys, it is important to stop from time to time and carefully scrutinize the soil and duff surface for sporocarps. For example, when mushrooms other than the target species are observed. *Otidea spp.* and *Sarcosoma mexicana* are often found during breaks, or when stopping to collect other species.

B. Extent of Surveys

For the purposes of this methodology, the project area is defined as the area on the ground receiving direct impacts. Direct impacts are those which cause physical disturbance to any surface, substrate, or potential host trees (*Abies* for *Polyozellus* and other tree species in the *Pinaceae* for the other fungi) within any given area. The survey area also encompasses a zone subject to indirect impact from management activities (Chen et al. 1995, Harris 1984). Examples of indirect impacts include, but are not limited to, changes in the amount of sunlight reaching the forest floor, changes in microclimatic conditions (i.e., humidity, soil moisture and temperature, wind speed and direction).

C. Timing of Surveys

Timing of surveys varies between species, and recommended months for each is given in section I.F. In general, surveys should begin either (1) within 1 week before or after September 1 in WA, October 1 in OR, and November 1 in CA or (2) within 1-2 weeks after a late summer/fall rainfall of 1 cm. (½ inch) or more whichever is earliest. The late summer/ fall surveys would be terminated by persistent snow or a persistent hard freeze which impacts the understory (e.g., you couldn't get a shovel into the ground). Winter/spring surveys should commence after freezing conditions have ceased, and may continue into early summer. Each project area should receive three survey visits at 2-3 week intervals during the potential months of fruiting for the species. This will accommodate the seasonal variation in weather conditions and in fruiting by the species, thereby increasing the chance of detection. If persistent freezing conditions occur before the three visits can be completed with the prescribed interval (i.e., the 2-3 week interval), then the number of visits completed will constitute the reasonable survey effort and will meet the objective of this protocol.

For areas where the date in the preceding paragraph has passed, surveys should begin within 2-3 weeks of receiving this protocol to initiate the fall, 1999 season.

D. Documentation

1. Documenting the Presence of the Species

If populations of the species are found, mark the location of the populations on a field map (e.g., 7.5 minute USGS topographic maps) and aerial photo, clearly labeling as to which species was found. Specimens of the fungus must be collected and dried, preferably after taking notes on the fresh colors (particularly for *Otidea spp*.) and noting the gelatinous context for *Sarcosoma*

mexicana. The dried specimens can be sent to the regional mycologist for verification. Complete the "Survey Strategy 2 Field Form" (Appendix C in the *Bridgeoporus nobilissimus* survey protocol [Hibler and O'Dell, 1998]) for each location. We recommend using a separate map from the one that delineates the aerial extent of the field survey. We highly recommend delineating the extent of the population on the maps or photos as this information is invaluable in relocating the population and developing management recommendation for the populations.

2. Documenting the Absence of the Species

If the species was not encountered in the field survey or was absent in a portion of the area surveyed, list the target species and document the absence of these species within the survey area. Documentation should include sufficient description of survey activity to determine that an adequate aerial survey was completed at the appropriate time of year and climatic conditions, and in the probable suitable habitat within and adjacent to the proposed project area. Include in this documentation the extent of the survey delineated on field maps and aerial photos, and a record of the different habitat and ecological conditions that were investigated for the species. Submit appropriate documentation for the administrative record and file.

E. Information to Collect Beyond Presence/Absence

Collection of information beyond presence/absence, location and basic habitat description is optional, but highly recommended. A complete record of detailed habitat and population information for occurrences of these species will contribute to our knowledge of the species and will assist us in our management of the species. Use Appendix D from the *Bridgeoporus nobilissimus* survey protocol (Hibler and O'Dell, 1998) to record data for fields currently in the known site database or ISMS for sites where these species are documented.

Data Management

A. Data Quality Assurance

A data steward should be designated for each administrative unit responsible for the quality and completeness of the survey data, including the pre-field review and the field survey information. This includes adequate and accurate data collection, prompt and accurate data entry into the corporate database (ISMS) when it becomes available, and hard copy formats. This is an important aspect to ensure credibility of the interpretations and analysis or management direction which are based on this data. Data quality will be assured at the local level, and will adhere to any regional agency standards for data management.

B. Data Storage

Data will be stored at the administrative unit and be available in a corporate database for local and regional use according to policy developed for the ISMS database and Survey and Manage taxa. Site locations for these species will be available in a GIS layer that is linked to a database with supporting information. Electronic and hard copies will be maintained and accessible to agency personnel requiring this information for successfully implementing the Survey and Manage Standard and Guideline and other agency goals under the Northwest Forest Plan. The hard copy file will include documentation of pre-field review, field survey data, field form and field notes, voucher specimen location, and any other supporting information which should be kept as case file documentation.

Surveying Skills

A. Surveyor Background/Qualifications/Skills

Personnel with skill in recognition, collection, and identification of these particular fungal species and in the identification of vascular plant species and plant communities for the geographical area of interest, are required. Personnel need to be experienced in proper collection of fungus voucher specimens and recording of appropriate information on fungus features needed for later laboratory identification. They also need to be experienced in field techniques, including aerial photo and map interpretation, route finding, and ecological/floristic field observations to be able to document the location, ecological conditions and habitats surveyed for and occupied by the species.

References

Castellano, M. and O'Dell, T.E. 1997. Management Recommendations for Survey and Manage Fungi. Publisher and place of publication unknown, ca. 300 pp.

Castellano, M.A., Smith, J.E. and O'Dell, T.E. in press. *Manual for the Identification of Fungi of late successional forests in the Pacific Northwest*. USDA Forest Service General Technical Report PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Castellano, M.A., Smith, J.E. and O'Dell, T.E., Cazares, E., and Nugent, S. 1999. Handbook to Strategy 1 Fungal Species in the Northwest Forest Plan. USDA Forest Service General Technical Report PNW-GTR-476. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 195p.

Chen, J., J.F. Franklin, and T.A. Spies. 1995. Growing-Season Microclimatic Gradient From Clearcut Edges Into Old-Growth Douglas-fir Forests. Ecological Applications 5(1):74-80.

Egli, S.; Ayer, F.; Chatelain, F. 1990. Der Einfluss des Pilzsammelns auf die Pilzflora. Mycologia Helvetica. 3: 417-428. [In German, English summary]

Franklin, J.F. and C.T. Dyrness. 1973. Natural Vegetation of Oregon and Washington. Pacific Northwest Forest and Range Experiment Station, U.S. Department of Agriculture Forest Service, General Technical Report PNW-8, Portland, OR.

Harris, L.D. 1984. The Fragmented Forest: Island Biogeography Theory and the Preservation of Biotic Diversity. University of Chicago Press, Chicago,USA.

Hibler, C. and T.E. O'Dell. 1998. Survey Protocols for *Bridgeoporus (=Oxyporus) nobilissimus.* USDA Forest Service Regional Ecosystem Office, Portland, OR. 15 pp.

O'Dell, T.E., J.F. Ammirati and E.G. Schreiner. in press. Canadian Journal of Botany. Ectomycorrhizal Basidiomycete Diversity and Abundance on a Moisture Gradient in the *Tsuga heterophylla* Zone.

Norvell, L. 1995. Loving the chanterelle to death? The ten-year Oregon chanterelle project. McIlvainea. 12: 6-25.

Oregon Natural Heritage Program. 1998. Rare, Threatened and Endangered Species of Oregon. Oregon Natural Heritage Program, Portland, Oregon, 92 pp.

Tylutki, E. E. 1993. Mushrooms of Idaho and the pacific Northwest. Volume 1 Discomycetes. University of Idaho Press, Moscow, ID, 140 pp.

USDA, Forest Service and USDI, Bureau of Land Management. 1994a. ROD for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl and standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Bureau of Land Management, Oregon/Washington State Office, Portland, OR..

USDA, Forest Service and USDI, Bureau of Land Management. 1994b. Final supplemental EIS on management of habitat for late-successional and old- growth related species within the range of the northern spotted owl. Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon.